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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

KIELIN, ERIK J

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 09/29/2003

21

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/905,157

Applicant(s)

LEWIS ET AL.

Examiner

Erik Kielin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-42 is/are pending in the application.
- 4a) Of the above claim(s) 6-8, 18-20 and 31-40 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 9-17, 21-30, 41 and 42 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8 September 2003 has been entered.

Election/Restrictions

2. Newly submitted claim 40 is directed to an invention that is independent or distinct from the invention originally claimed for the following reasons:

Applicant elected claims drawn to Group I-B in Paper No. 8, filed 29 August 2002. Claim 40 does not read on this species but introduces an additional species similar to the species drawn to a photovoltaic cell (Group I-C) or a field effect transistor (Group I-D), as in the restriction requirement in Paper No. 6, filed 25 June 2002 because it requires an electrode. Moreover, Examiner has already examined plural, non-elected species including Groups I-A, I-F, I-G, I-H, and I-I, in addition to the elected species I-B. This is more than a reasonable number of species. No more species will be examined. See additionally the instant specification, paragraphs [0013] through [0016] for the plurality of groups of species (embodiments) indicated by Applicant. More specifically paragraph [0013] indicates that electrical devices including the electrical structure are "another set of embodiments." In this case an electrode is an electrical device, just like non-elected devices of the photovoltaic cell and the FET.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claim 40 is withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Moreover, as stated in Paper No. 6,

“Applicant is advised that a reply to this requirement must include an identification of the species that is elected consonant with this requirement, and a listing of all claims readable thereon, **including any claims subsequently added.**” (Emphasis added.)

Applicant has not indicated upon which species the new claims read. However, it appears that new claims 41 and 42 which depend from claim 1 read on the elected species of Group I-B and will be examined.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-5, 9-11, 41, 42, and 13-17, 21, 25-30 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5,429,708 (**Linford et al.**).

Regarding claims 1 and 13, **Linford** discloses an electrical structure comprising a silicon-containing material **12** having a surface **40**; and an organic monolayer **45** chemically bonded to the surface **40** of the silicon-containing material **12**, wherein an electrical property of the electrical structure is improved (paragraph

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bridging cols. 8-9) compared to a same structure without the organic layer, as indicated by **Linford** (col. 1, 21-31; paragraph bridging cols. 8-9).

Regarding claims 2, 3, 14 and 15, as just noted the organic layer inherently affects the electrical property of the silicon-containing material, wherein any of the electrical properties is selected from a group consisting of surface recombination velocity, carrier lifetime, electronic efficiency, voltage, contact resistance, and resistance of a doped region. Evidence is the admission of Applicant and as indicated by **Linford**, as noted.

Regarding claim 4, the organic layer is a hydrocarbon (Fig. 4; col. 4, line 44 to col. 5, line 13).

Regarding claims 5, and 17, the organic layer is a polymer (Fig. 12; col. 5, lines 37-45).

Regarding claims 9-11 and 28-30, the silicon-containing material is monocrystalline, polycrystalline, amorphous, or porous (col. 1, lines 17-21).

Regarding claim 16, the organic layer is a monolayer (Figs. 3-12).

Regarding claims 21, the organic layer is formed by activating the surface of the silicon-containing material; and reacting the activated surface with a chemical, wherein during the reaction, a hydrocarbon group becomes chemically bonded to the silicon-containing material. (See col. 2, lines 6-45.)

Regarding claim 25, the hydrocarbon is an allyl, called "alkenyl" and structurally described as " $-C(R)=CH(R')$ " for example, in **Linford** (col. 5, lines 5-34).

Regarding claim 26, a polymer is formed by reaction with the surface-bound allyl group (col. 5, lines 37-46; paragraph bridging cols. 5 and 6).

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Regarding claim 27, the hydrocarbon group is an alkoxide group (col. 4, lines 44-49; Fig. 5).

Regarding claim 41, Linford uses a hydrogen-terminated silicon surface prior to forming the organic layer (Abstract).

Regarding claim 42, Linford uses a oxygen-terminated silicon surface prior to forming the organic layer (Figs. 1A and 1B).

3. Claims 13, 21-24 are rejected under 35 U.S.C. 102(b) as being anticipated by JP 6-84853 A (**Tsukune** et al.).

Regarding claims 13 and 21-24, **Tsukune** discloses activating a silicon-containing material (silicon, Si) by halogenating with HF (F is the halogen) and then reacting the activated silicon-containing material surface with a chemical (methanol) to chemically bond a monolayer of methyl groups to the silicon in the surface which has only 1 carbon atom. (See paragraphs [0010]-[0012], translation provided.) **Tsukune** teaches that the electrical property of, at least, voltage in the silicon is improved because defects are prevented in the contact between the tungsten or silicon deposited on the silicon-containing material (wafer) (paragraph [0018]).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Linford** in view of US 3,961,353 (**Aboaf** et al.).

The prior art of **Linford**, as explained above, discloses each of the claimed features except for indicating the porosity to have an upper limit of 30%.

Aboaf teaches a semiconductor device having a porous layer of silicon **12**, wherein the silicon has a porosity of 15%. The silicon layer has a protective layer **15** formed there over to prevent oxidation in subsequent processes. (See col. 2, lines 41-61; col. 3, lines 3-13.)

It would have been obvious for one of ordinary skill in the art, at the time of the invention to limit the porosity to no greater than 15% in order to form the device in **Aboaf**. Furthermore, the degree of porosity at no greater than 30% is an obvious matter of design choice and of routine optimization, depending upon the particular application of the porous silicon, at the suggestion of **Linford** to use porous silicon --especially since Applicant has provided no reason why the percentage porosity of the silicon bears any criticality to the formation of the organic layer.

Response to Amendment

6. The declaration filed on 4 August 2003 under 37 CFR 1.131 has been considered but is ineffective to overcome the **Linford** and **Tsukune** references.

Each of the **Linford** and **Tsukune** references teach that the electrical properties may be improved. For example, **Linford** states in the paragraph bridging cols. 8-9,

“For example, such molecular layers are suitable for use with: silicon based, micromechanical devices to minimize stiction; **electrode surfaces** to **optimize** their **electrochemical properties** for use in **fuel cells** or

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electrochemical synthetic cells; solar cells as an antioxidation coating, silicon chips as a monomolecular photoresist, and Si-based chemical sensors to alter the electrical properties of the underlying Si.”
(Emphasis added.)

Optimization, by definition is to improve. Accordingly, Linford expressly and inherently teaches improvement of the electrical properties.

Response to Arguments

Applicant argues that Linford does not teach improvement of the electrical properties. For reasons just indicated, this argument is very clearly in error.

Applicant argues that Linford is not teaching an electrical structure. Then what are the solar cell, the full cell, the electrochemical synthetic cell, the silicon chips, if they are not electrical structures?

Moreover, Applicant's declaration does more to prove that some embodiments indicated in the instant specification are not enabled.

Examiner stands on the indication that the Declaration filed 4 August 2003 is deficient for the reasons indicated in the Advisory action filed 15 August 2003. If it is not “reasonable to test each and every electrical property and each and every organic group set forth in the cited references” then Applicant admits that Applicant has failed to establish that each of the laundry list of organic compounds each improve all of the claimed electrical properties for all electrical structures. **Verily Applicant claims any organic layer (claim 1), any hydrocarbon (claim 3), any polymer (claim 4) improves the electrical properties while simultaneously providing a declaration that this is not the case.** Accordingly, the statement that the Declaration is deficient

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is no more unreasonable than the breadth of Applicant's claims. Moreover, common sense alone indicates that Linford would not suggest the modification of the silicon surface if it were to make matters worse rather than better. Linford expressly indicates that the electrical properties are improved (optimized).

Tsukune also reads on the claims for reasons of record which **Applicant has failed to address**. Tsukune teaches that the voltage is improved in paragraph [0018], as stated in the rejection previously filed (4 March 2003) and as repeated above.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached at 703-308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.


Erik Kielin, Ph.D.
Primary Examiner
September 27, 2003